



# Beam Instrumentation Summary

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for the beam instrumentation group

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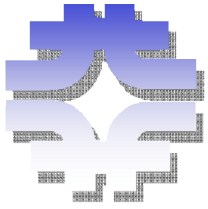
BROOKHAVEN
NATIONAL LABORATORY



# Outline

Overall considerations

Ongoing Tasks

- Lumi + Tune feedback

Upcoming proposals for FY06 start

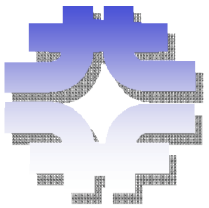
- Schottky detectors + ZDC

Other discussions

- Data acquisition and control interfaces

Budgets

Conclusions



# Overall considerations

Healthy progress in all areas:

- Successful design review of the tune feedback
  - Reported on Monday
    - Ideal outcome
- Tune feedback is very nice model of collaborative effort
  - CERN is actively integrated with the effort
    - Contributing hardware and people
  - beam tested on RHIC applied to LHC
- Lumi design review on Monday 4/11

# Overall Considerations (2)

Other activities

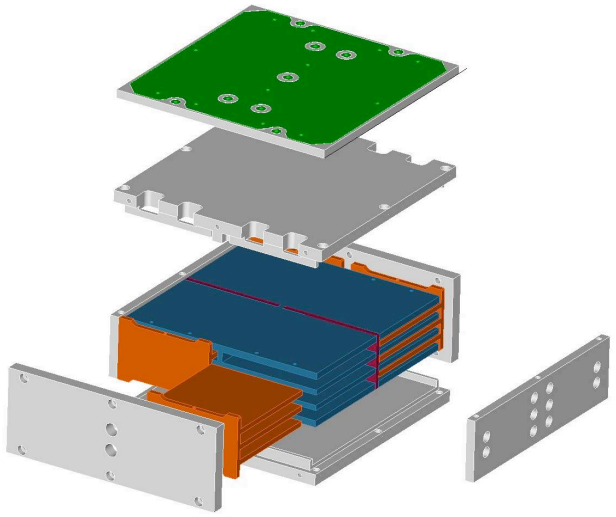
- Schottky proposal ready to be presented
- Opportunity for ZDC calorimeter from the experimenters

- Collaboration on data acquisition and controls integration
  - Involves CERN, FNAL and BNL, LBNL

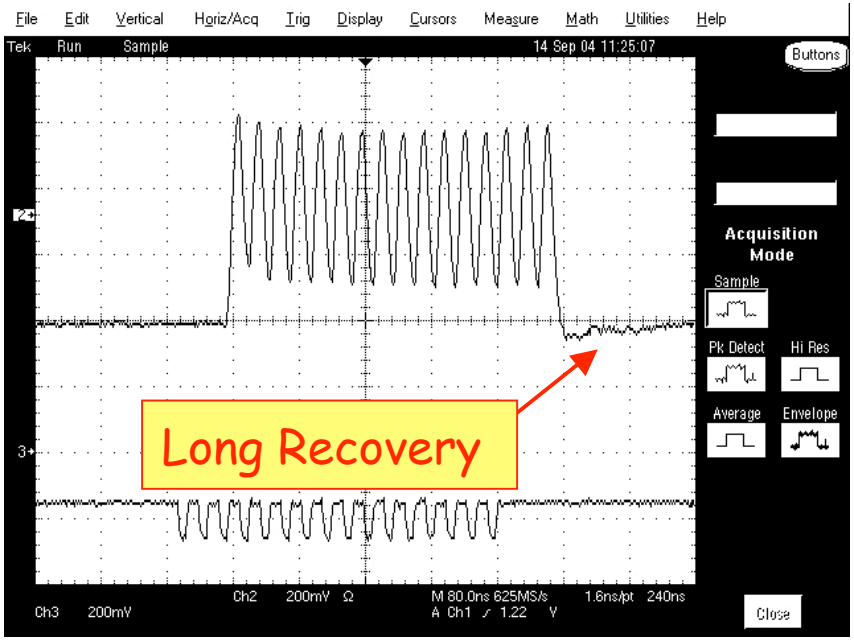
- Established points of contact across labs

# Luminosity Monitor

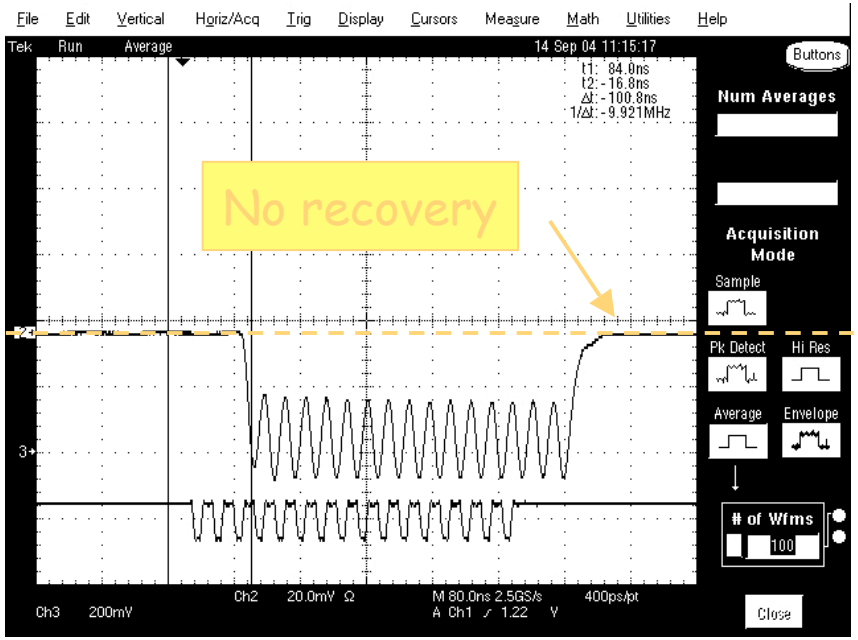
- Improved in multiple areas
  - Front end processing + deconvolution
  - High speed test plan
  - Rad hardness study
    - Not feasible?



# Pole-Zero Cancellation: Response to a burst (Cd=82pF)

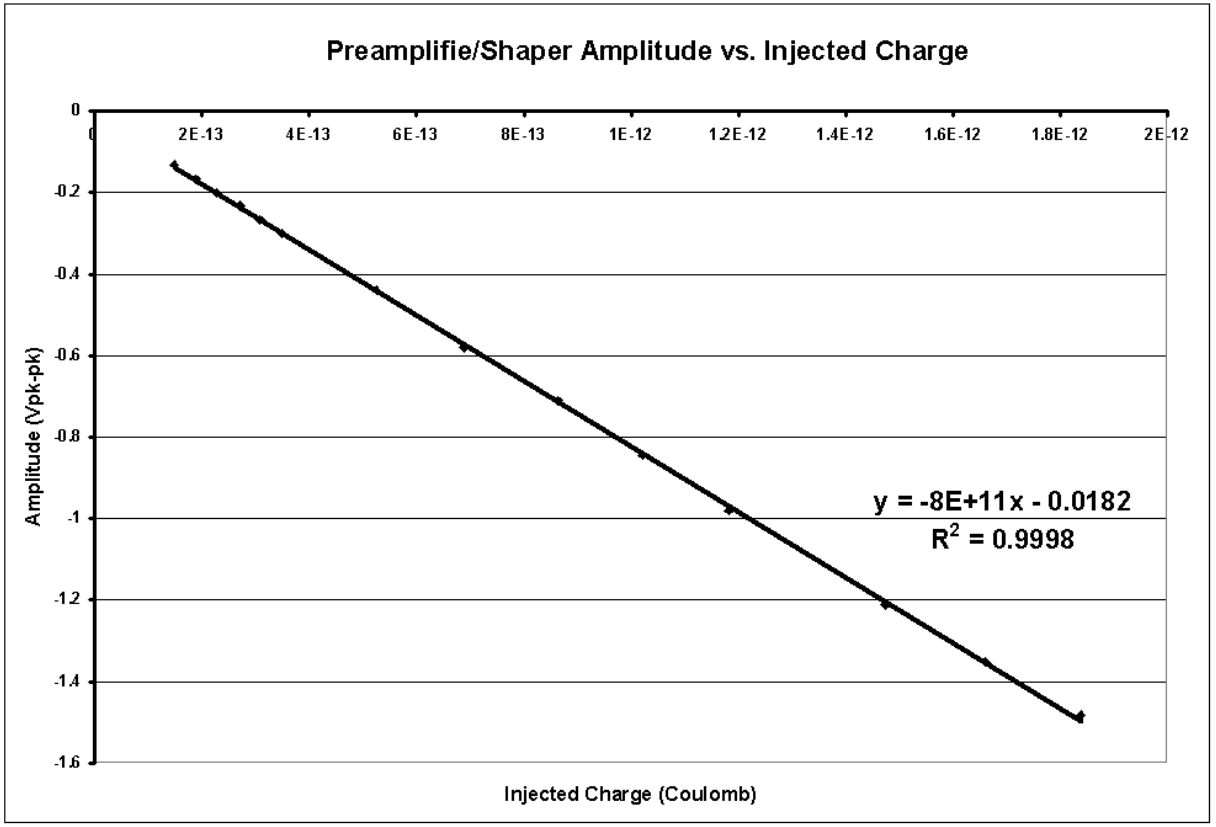



Preamplifier + Pavia Shaper version2




Preamplifier + SK4 Shaper

# Preamplifier-SK4 Shaper Linearity




# Tune Feedback

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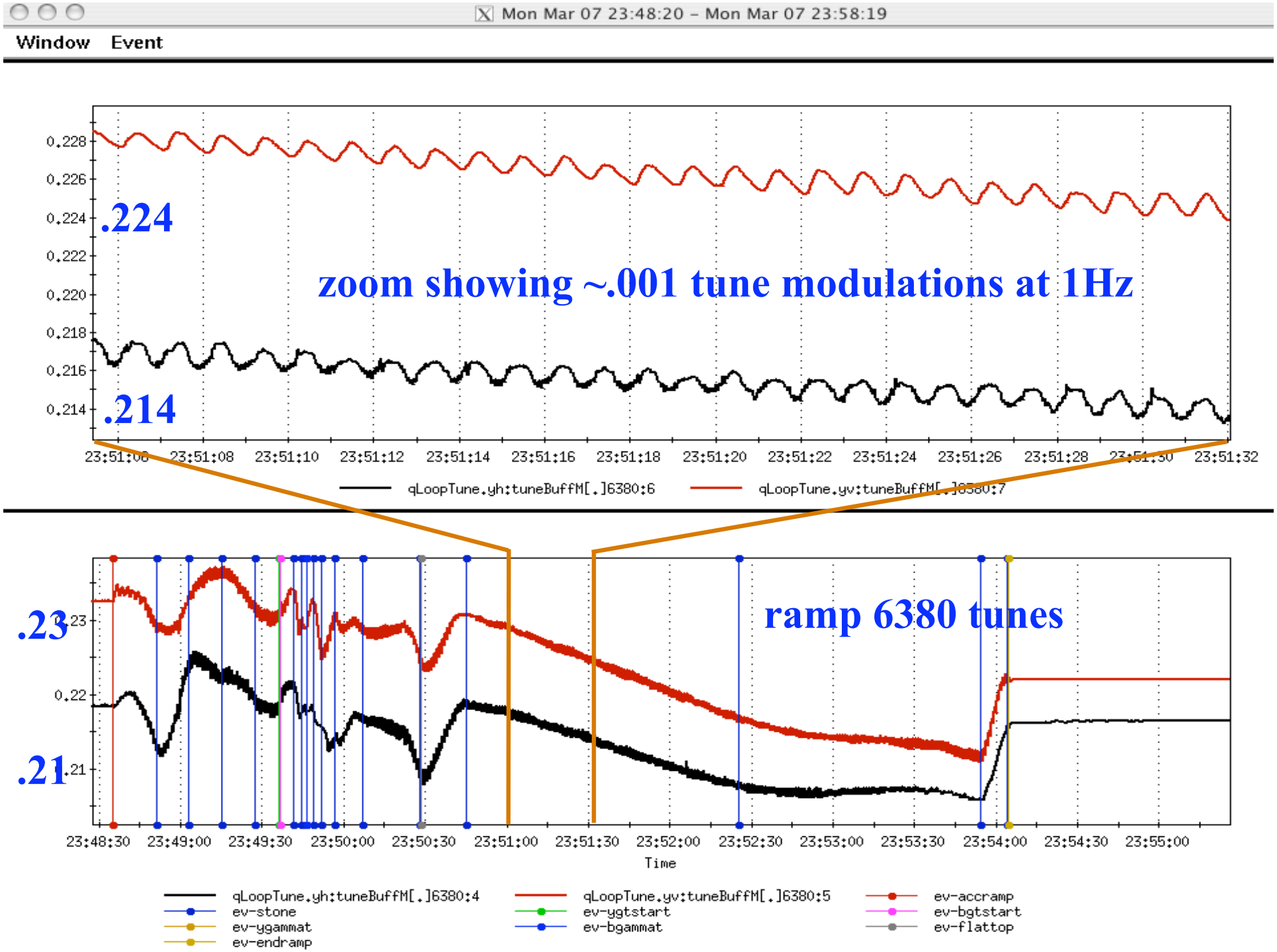
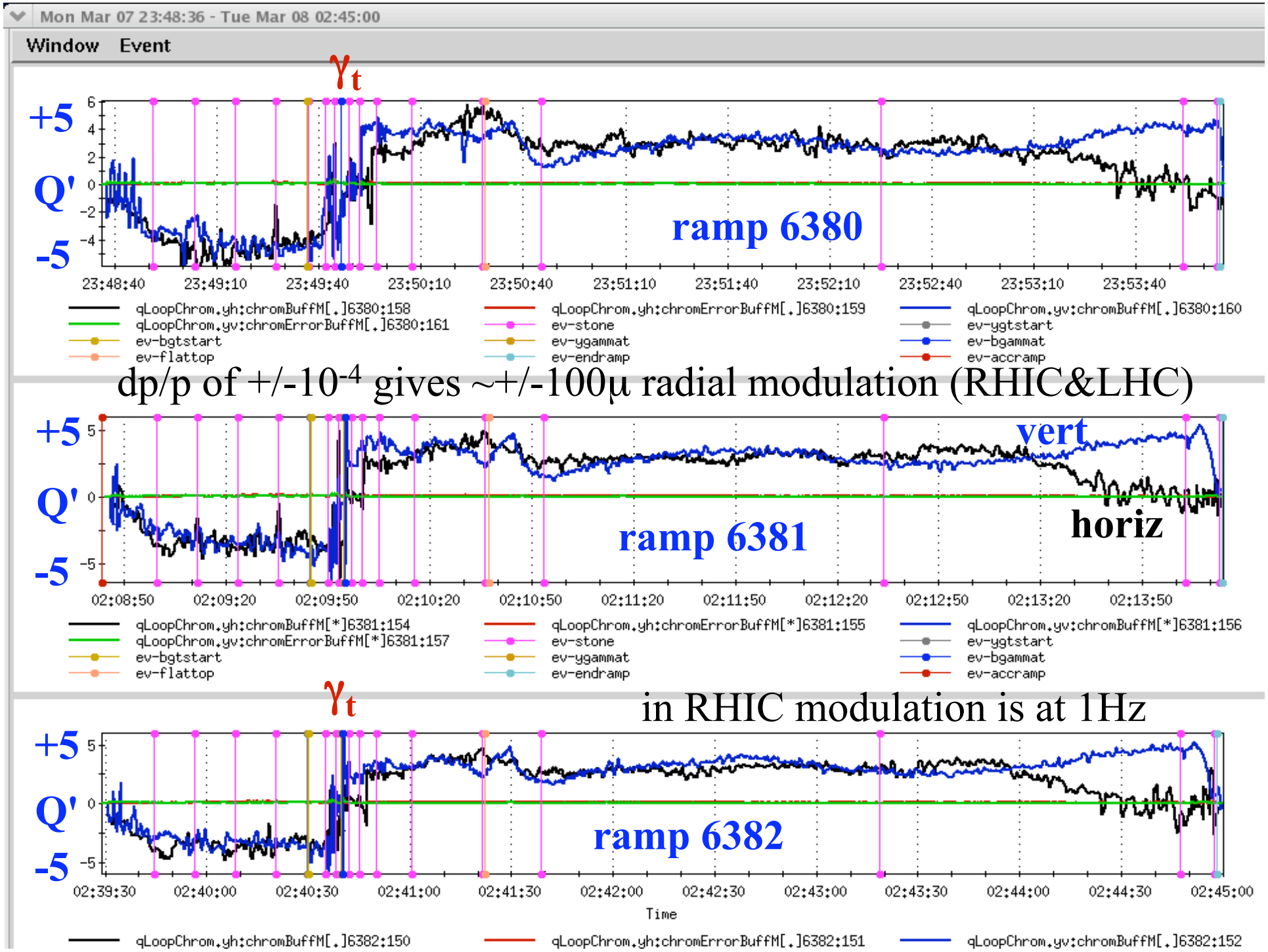
**driven by need to accomplish chromaticity feedback - snapback**

3D front end - a major advance (solves the RHIC transition dynamic range problem); running at PS, SPS, Tevatron, RHIC

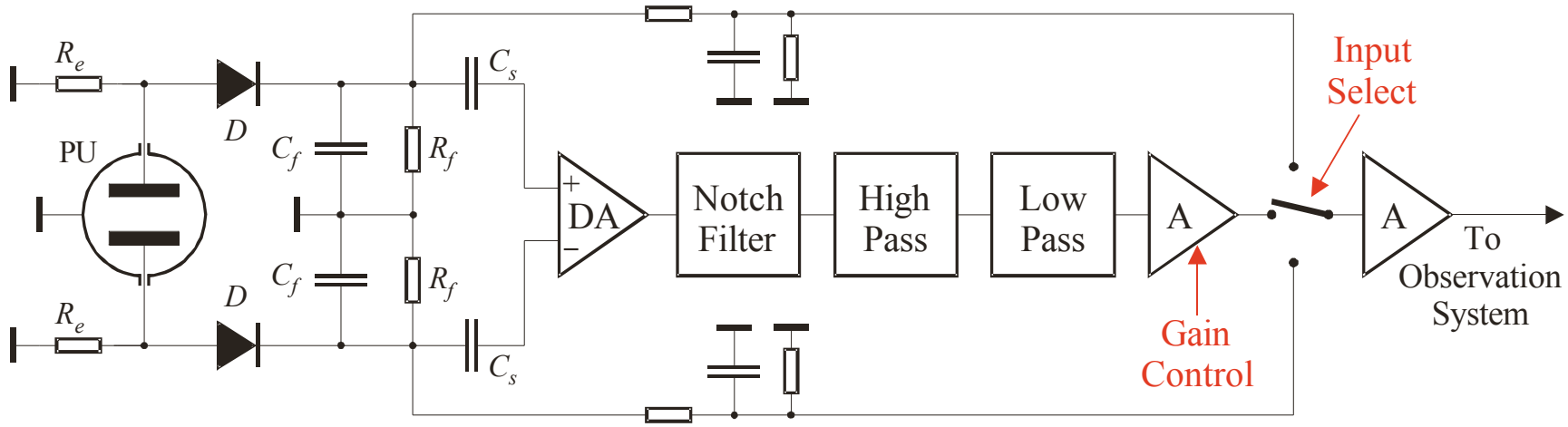
60Hz problem - discovered by 3D front end, working on solutions from both magnet and PLL ends

coupling - this was the second major RHIC problem, we have advances both in measurement techniques and correction algorithms


Mon Mar 07 23:48:20 – Mon Mar 07 23:58:19
Window Event
.224
zoom showing ~.001 tune modulations at 1Hz
.214
qLoopTune.yh:tuneBuffM[.]6380:6
qLoopTune.yv:tuneBuffM[.]6380:7
.23
ramp 6380 tunes
.21
Time
qLoopTune.yh:tuneBuffM[.]6380:4
ev-stone
ev-ygammat
ev-endramp
qLoopTune.yv:tuneBuffM[.]6380:5
ev-ygtstart
ev-bgammat
ev-accramp
ev-bgtstart
ev-flattop

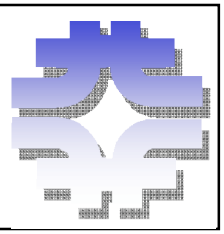

Mon Mar 07 23:48:36 - Tue Mar 08 02:45:00
Window Event
γt
+5
Q'
-5
ramp 6380
23:48:40 23:49:10 23:49:40 23:50:10 23:50:40 23:51:10 23:51:40 23:52:10 23:52:40 23:53:10 23:53:40
qLoopChrom.yh:chromBuffM[.]6380:158
qLoopChrom.yh:chromErrorBuffM[.]6380:159
qLoopChrom.yv:chromBuffM[.]6380:160
qLoopChrom.yv:chromErrorBuffM[.]6380:161
ev-stone
ev-ygtstart
ev-bgtstart
ev-ygammat
ev-bgammat
ev-flattop
ev-endramp
ev-accramp
dp/p of +/-10-4 gives ~+/-100μ radial modulation (RHIC&LHC)
+5
Q'
-5
vert
horiz
ramp 6381
02:08:50 02:09:20 02:09:50 02:10:20 02:10:50 02:11:20 02:11:50 02:12:20 02:12:50 02:13:20 02:13:50
qLoopChrom.yh:chromBuffM[*]6381:154
qLoopChrom.yh:chromErrorBuffM[*]6381:155
qLoopChrom.yv:chromBuffM[*]6381:156
qLoopChrom.yv:chromErrorBuffM[*]6381:157
ev-stone
ev-ygtstart
ev-bgtstart
ev-ygammat
ev-bgammat
ev-flattop
ev-endramp
ev-accramp
γt
in RHIC modulation is at 1Hz
+5
Q'
-5
ramp 6382
02:39:30 02:40:00 02:40:30 02:41:00 02:41:30 02:42:00 02:42:30 02:43:00 02:43:30 02:44:00 02:44:30 02:45:00
Time
qLoopChrom.yh:chromBuffM[.]6382:150
qLoopChrom.yh:chromErrorBuffM[.]6382:151
qLoopChrom.yv:chromBuffM[.]6382:152

# BBQ Architecture





# Schottky Monitors



Advanced enabling technology for:

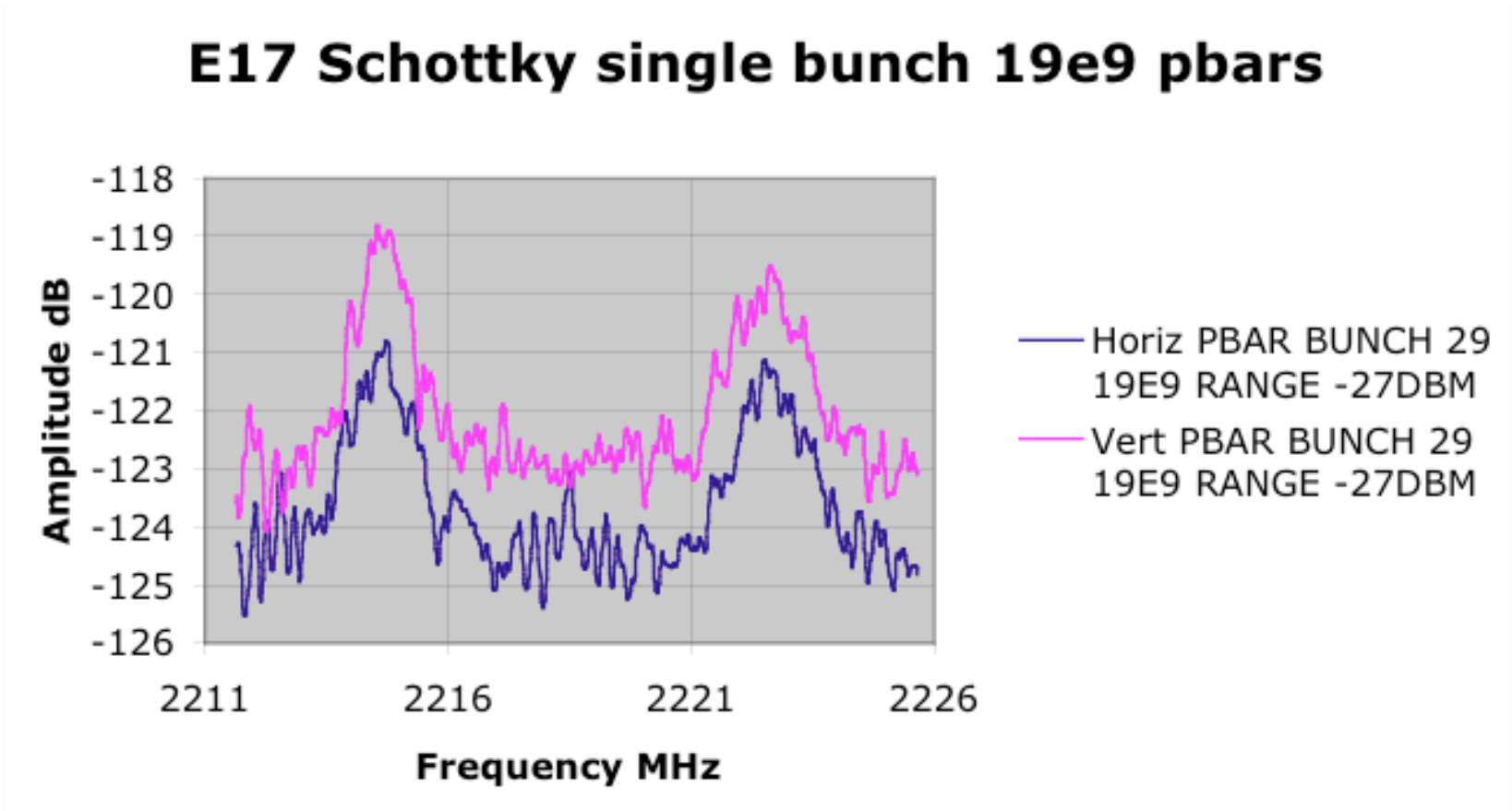
- Non invasive tune measurement for each ring
- Non invasive chromaticity measurements
- Measure momentum spread
- Continuous online emittance monitor
- Measure beam-beam tune shift

Build in capability to monitor gain variation with time

Measure individual or multiple bunches

Collaboration meeting at BNL in March

# Schottky Single Bunch Results



# Schottky Plans

A task sheet will be submitted for consideration on time for the FY06 budget

Propose to:

- prepare dwgs for CERN's fab
- Build electronics for single/multi-bunch processing
- Support installation and hardware commissioning at CERN
- Leverage existing DAQ effort from other LARP activities

# ZDC

Used at RHIC as a source of background free low luminosity measurements

- Discriminates well beam residual gas backgrounds

Useful to cross calibrate luminosity monitors

Device supported (paid for) by NP (future) budget

Would benefit from integration with ongoing effort for luminosity measurements

Budget request to support travel and integration only

# Data Acquisition Plans

Common task: acquire and sample 40 MHz data and interface with CERNs control system

Collaborative discussions during this meeting to avoid overlap of efforts

- Lumi projects to share DAQ
- Tune and Schottky to share DAQ with large DR

New proposals plan to leverage existing efforts on DAQ systems

CERN is well integrated and providing VME platforms and DABIV boards complete with installation and software support

# Budget Guidelines

| | FY05 | FY06 | FY07 |
|---|---|---|---|
| Lumi | 395 | 950 | 811 |
| Tune FB (BNL/FNAL) | 195 | 300/25 | 350/ |
| Schottky* (BNL/FNAL) | 15 | 20/225 | /55 |
| ZDC* | | | |

*If approved

NOTE: PRELIMINARY GUIDANCE

# Conclusions

- Beam instrumentation tasks are well underway
  - New ideas are surfacing and becoming proposals
  - Good collaborative efforts among all labs

- Integration with AP and commissioning activities
  - “everyone knows how useful Schottky signals are”
- Essential to continue ongoing communication through dedicated meetings and workshops as well as cross-Atlantic travel

- Funding uncertainty causes the need for contingency planning
- Important to define success